Claims

1. A method for improving image quality while reducing a bit rate associated with a video signal, comprising:

defining a neighborhood of pixel locations around a pixel;

calculating a difference between each pixel value associated with the neighborhood of pixel locations and a pixel value of the pixel;

defining a smoothing filter; and

determining whether to apply the smoothing filter to the pixel according to a weight factor associated with the difference.

2. The method of claim 1, wherein the method operation of calculating a difference between each pixel value associated with the neighborhood of pixel locations and a pixel value of the pixel includes,

summing the difference to yield a summed value; and

normalizing the summed difference to yield the weight factor.

3. The method of claim 2, wherein the method operation of normalizing the summed difference to yield the weight factor includes,

dividing the summed difference by a number of pixel locations in the neighborhood.

4. The method of claim 1, wherein a degree of the difference between each pixel value associated with the neighborhood of pixel locations and a pixel value of the pixel represents a region type.

5. The method of claim 1, wherein the method operation of determining whether to apply the smoothing filter to the pixel according to a weight factor associated with the difference includes,

calculating a difference associated with the video signal and an output of the smoothing filter;

combining the weight factor with the difference associated with the video signal and the output of the smoothing filter to yield a combined value; and

adjusting the output of the smoothing filter with the combined value.

6. A method for adaptively filtering a video signal prior to encoding, comprising:

calculating a local gradient indicative of a region type;

determining a weight factor based upon the local gradient; and

applying the weight factor to a difference signal according to the region type.

7. The method of claim 6, wherein the method operation of calculating a local gradient indicative of a region type includes,

defining a neighborhood of values around a current pixel value; and

quantifying a difference between each of the neighborhood of values and the current pixel value.

8. The method of claim 7 further comprising:

comparing the difference to a threshold value; and

applying a smoothing function to the current pixel value when the difference is greater than the threshold value.

9. The method of claim 6, further comprising:

applying a smoothing filter to the video signal;

calculating a difference between the video signal and an output of the smoothing filter; and

representing the difference between the video signal and the output of the smoothing filter as the difference signal.

10. The method of claim 6, further comprising:

receiving a signal to reduce a bit rate; and

in response to receiving the signal the method includes,

applying a smoothing filter to the video signal.

11. The method of claim 6, wherein the method operation of applying the weight factor to a difference signal according to the region type includes,

constructing the weight factor in a manner such that a higher weight factor diminishes a contribution of a smoothing filter.

12. A method for processing a video signal prior to encoding, comprising:

defining a neighborhood of pixel locations around a pixel;

calculating a gradient between each neighborhood pixel and the pixel;

computing a gradient summation associated with the pixel; and

classifying the pixel as one of a noise pixel and a non-noise pixel based upon the gradient summation.

13. The method of claim 12 wherein the method operation of computing a gradient summation associated with the pixel includes,

defining a mapping function correlating the gradient to a concave function symmetric around zero, the concave function having a range between zero and one, inclusive.

14. The method of claim 13 wherein the concave function includes a tuning factor, the tuning factor configured to modify a profile of the concave function.

15. The method of claim 13, further comprising:

modulating a tuning factor associated with the concave function;

in response to the modulating of the tuning factor, the method includes,

forcing the video signal to be smoothed.

16. A computer readable medium having program instructions for improving image quality while reducing a bit rate associated with a video signal, comprising:

program instructions for defining a neighborhood of pixel locations around a pixel;

program instructions for calculating a difference between each pixel value associated with the neighborhood of pixel locations and a pixel value of the pixel;

program instructions for defining a smoothing filter; and

program instructions for determining whether to apply the smoothing filter to the pixel according to a weight factor associated with the difference.

17. The computer readable medium of claim 16, wherein the program instructions for calculating a difference between each pixel value associated with the neighborhood of pixel locations and a pixel value of the pixel includes,

program instructions for summing the difference to yield a summed value; and

program instructions for normalizing the summed difference to yield the weight factor.

18. The computer readable medium of claim 17, wherein the program instructions for normalizing the summed difference to yield the weight factor includes,

program instructions for dividing the summed difference by a number of pixel locations in the neighborhood.

19. The computer readable medium of claim 16, wherein the program instructions for determining whether to apply the smoothing filter to the pixel according to a weight factor associated with the difference includes,

program instructions for calculating a difference associated with the video signal and an output of the smoothing filter;

program instructions for combining the weight factor with the difference associated with the video signal and the output of the smoothing filter to yield a combined value; and

program instructions for adjusting the output of the smoothing filter with the combined value.

20. A computer readable medium for adaptively filtering a video signal prior to encoding, comprising:

program instructions for calculating a local gradient indicative of a region type;

program instructions for determining a weighting factor based upon the local gradient; and

program instructions for applying the weighting factor to a difference signal according to the region type.

21. The computer readable medium of claim 20, wherein the program instructions for calculating a local gradient indicative of a region type includes,

program instructions for defining a neighborhood of values around a current pixel value; and

program instructions for quantifying a difference between each of the neighborhood of values and the current pixel value.

22. The computer readable medium of claim 20, wherein the program instructions for determining a weighting factor based upon the local gradient includes,

program instructions for normalizing a difference between each of the neighborhood of values and the current pixel value.

23. The computer readable medium of claim 20, further comprising:

program instructions for applying a smoothing filter to the video signal;

program instructions for calculating a difference between the video signal and an output of the smoothing filter; and

program instructions for representing the difference between the video signal and the output of the smoothing filter as the difference signal.

24. The computer readable medium of claim 20, further comprising:

program instructions for receiving a signal to reduce a bit rate; and

in response to receiving the signal the computer readable medium includes,

program instructions for applying a smoothing filter to the video signal.

25. The computer readable medium of claim 20, wherein the program instructions for applying the weighting factor to a difference signal according to the region type includes,

program instructions for constructing the weighting factor in a manner such that a higher weighting factor diminishes a contribution of a smoothing filter.

26. A computer readable medium having program instructions for processing a video signal prior to encoding, comprising:

program instructions for defining a neighborhood of pixel locations around a pixel;

program instructions for calculating a gradient between each neighborhood pixel and the pixel;

program instructions for computing a gradient summation associated with the pixel; and

program instructions for classifying the pixel as one of a noise pixel and a non-noise pixel based upon the gradient summation.

27. The computer readable medium of claim 26 wherein the program instructions for computing a gradient summation associated with the pixel includes,

program instructions for defining a mapping function correlating the gradient to a concave function symmetric around zero, the concave function having a range between zero and one, inclusive.

28. The computer readable medium of claim 27, further comprising:

program instructions for modulating a tuning factor associated with the concave function; and

in response to the modulating of the tuning factor, the computer readable medium includes,

program instructions for forcing the video signal to be smoothed.

29. An integrated circuit, comprising:

circuitry for filtering a signal prior to transmission to an encoding loop, the circuitry for filtering including,

circuitry for calculating a gradient between a pixel value and a neighboring pixel value associated with the signal;

circuitry for determining a weight factor based upon the local gradient; and

circuitry for applying the weight factor to a difference signal according to the region type.

30. The integrated circuit of claim 29, wherein the circuitry for calculating a local gradient indicative of a region type includes,

circuitry for defining a neighborhood of values around a current pixel value; and

circuitry for quantifying a difference between each of the neighborhood of values and the current pixel value.

31. The integrated circuit of claim 29, wherein the circuitry for determining a weight factor based upon the local gradient includes,

circuitry for normalizing a difference between each of the neighborhood of values and the current pixel value.

32. The integrated circuit of claim 29, further comprising:

circuitry for applying a smoothing filter to the video signal;

circuitry for calculating a difference between the video signal and an output of the smoothing filter; wherein the difference between the video signal and the output of the smoothing filter represents the difference signal.

33. The integrated circuit of claim 29, further comprising:

circuitry for receiving a signal to reduce a bit rate; and

circuitry for applying a smoothing filter to the video signal.

34. The integrated circuit of claim 29, wherein the circuitry for applying the weight factor to a difference signal according to the region type includes,

circuitry for constructing the weight factor in a manner such that a higher weight factor diminishes a contribution of a smoothing filter.

35. A system for processing an image data signal, comprising:

a prefilter configured to adaptively apply a smoothing function according to a gradient value, the gradient value representing a degree of difference between a value associated with a pixel and a neighborhood of pixel values around the pixel, wherein the degree of difference determines an extent of the smoothing function applied to the image data signal; and

an encoder configured to receive a processed signal from the prefilter.

36. The system of claim 35, wherein the encoder includes a rate control module capable of requesting smoothing of the image data signal through the prefilter.

37. The system of claim 35, wherein the encoder includes a discrete cosine transform (DCT) domain filter configured to reduce blocky artifacts.

38. The system of claim 35, wherein the prefilter includes logic for detecting a noise pixel associated with the image data.

39. The system of claim 38, wherein the logic for detecting a noise pixel associated with the image data includes,

logic for comparing the gradient value associated with the pixel to a threshold value; and

logic for applying a smoothing function to the pixel, wherein the smoothing function is configured for noise pixels.